Center of Excellence for Aircraft Noise and Aviation Emissions Research

Federal Aviation Administration
Air Transportation Centers of Excellence
3rd Joint Annual Meeting
5 November, 2003

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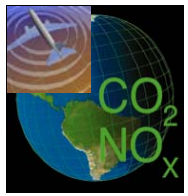
Office of Environment and Energy

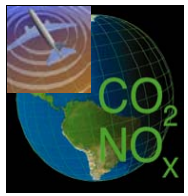
Outline

- Motivation
- Research Interests
- COE Highlights
- Summary



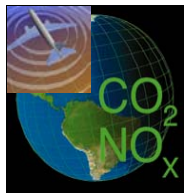
Aviation Industry Strategic Environment

- Security dominant near-term issue
- Industry financial weakness & uncertainty
- Airline operations down significantly
- Aviation environment impacts reduced



Future Drivers Remain "Stable"

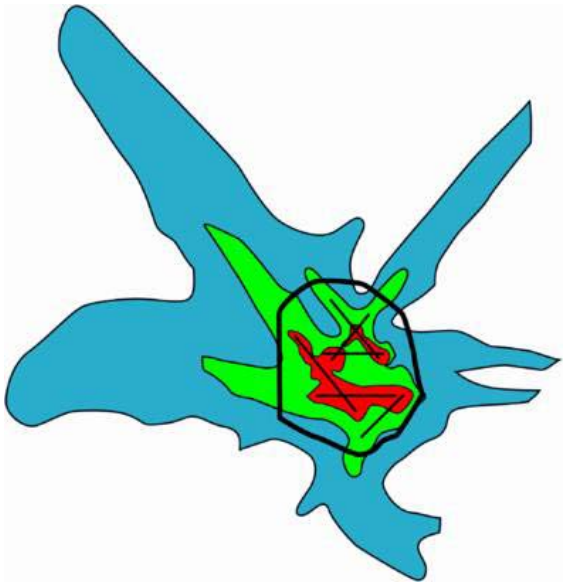
- Americans want safe, convenient, inexpensive air travel
- Americans want the environment protected
- Environmental issues remain a long-term capacity constraint on aviation
- Solutions a function of innovation and R&D investment



Aviation Environmental Challenges

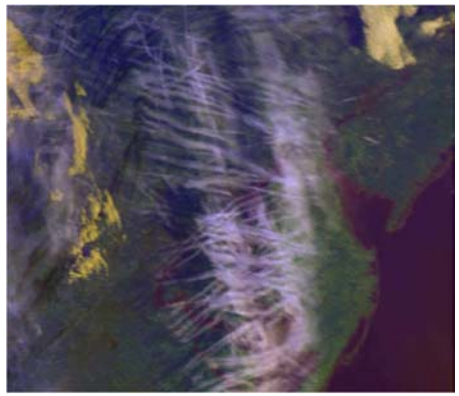
- Byproducts of aviation (noise and emissions) impact environment, quality of life, and health
- Environmental issues constrain system capacity
  - Aircraft noise issues are limiting airport capacity
    - Over 600 operational constraints at US airports
    - Over $300M spent each year to mitigate noise at US airports
    - Local community noise issues delay construction of new runways
    - International airports imposing increasingly stringent restrictions
  - Aircraft engine emissions becoming increasingly important
    - Over 25% of commercial airports in nonattainment or maintenance areas for national ambient air quality standards
    - 43 of 50 top airports in nonattainment or maintenance areas
    - Increased community concern about aviation emissions hinders capacity growth

Aviation Environmental Research Interests



Noise within airport boundaries

Constrain objectionable noise to within airport boundaries



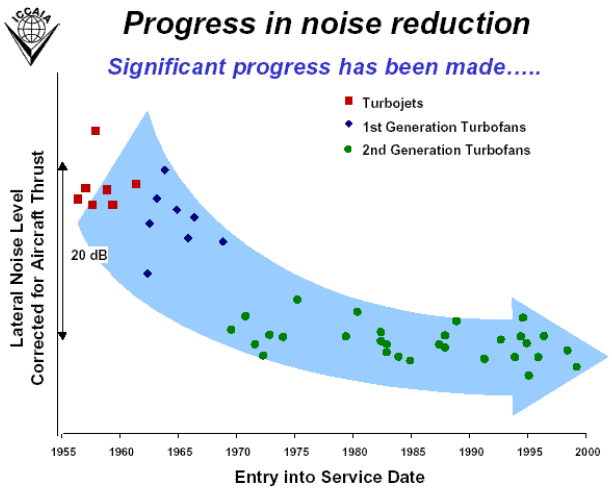
Global climate

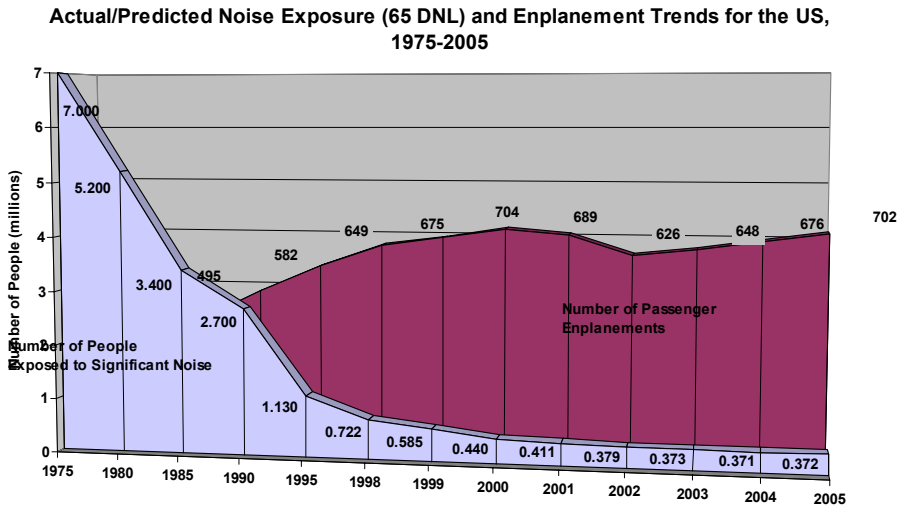
Reduce the impact of aviation on global climate

Air Quality

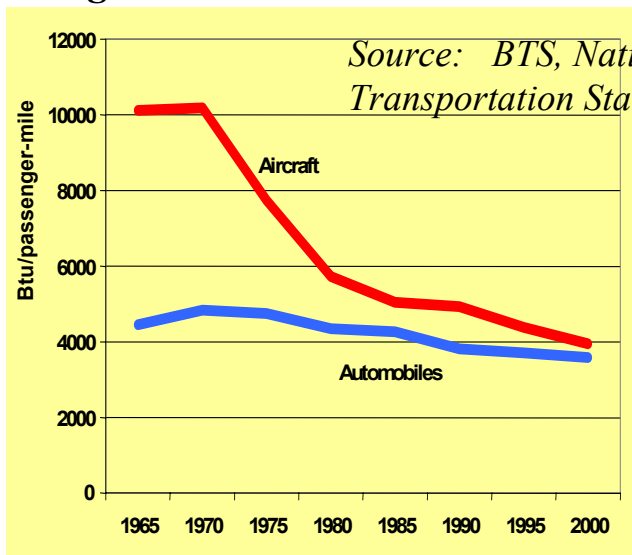
Reduce impact of aviation on local air quality

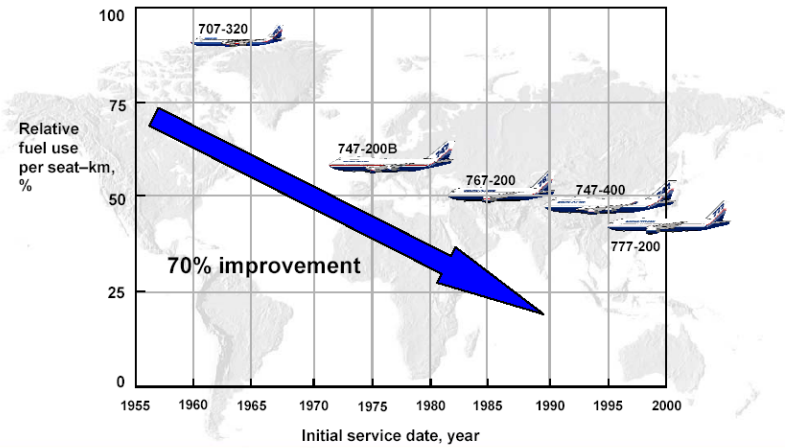
We Have Made Great Strides Reducing Aviation Noise & Emissions …….





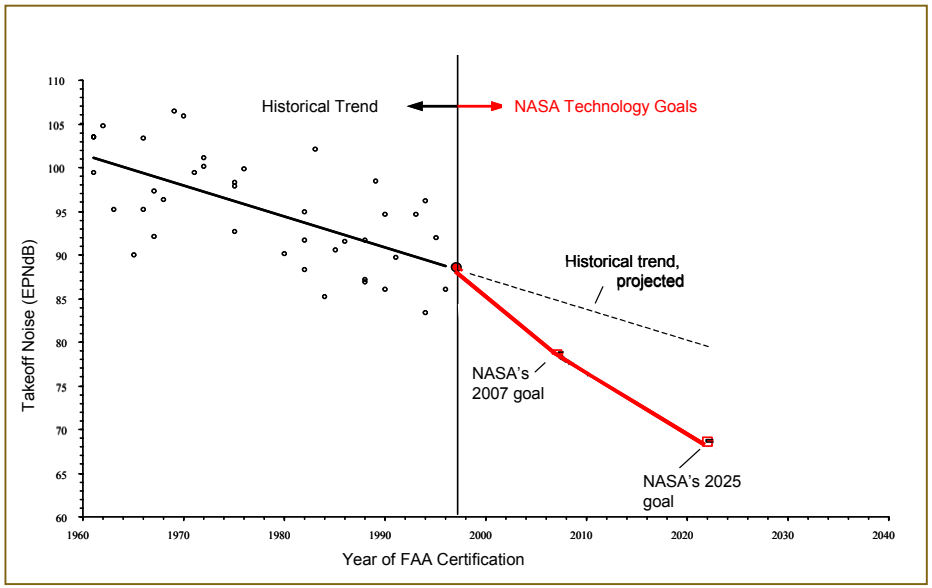
Progress in emissions reduction

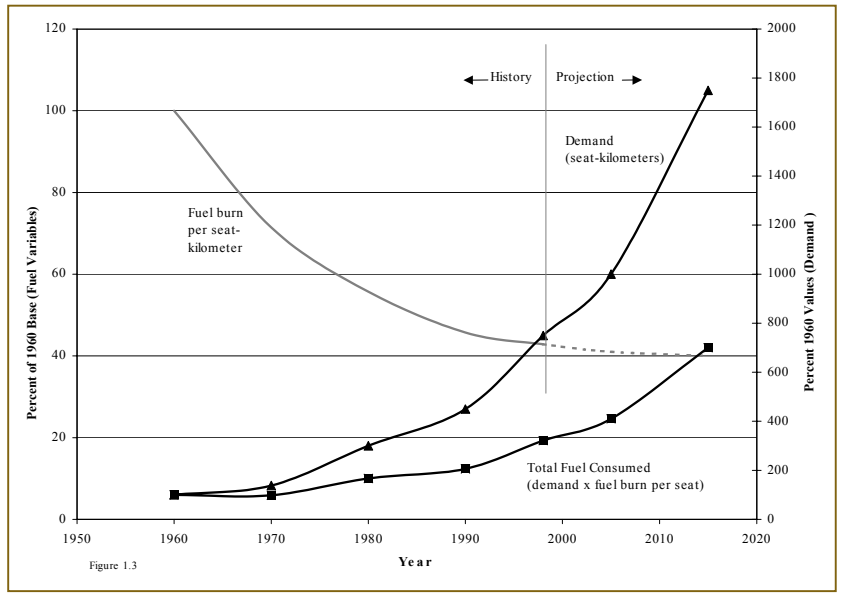




BOEING

… But Sustaining Trend Not Easy …

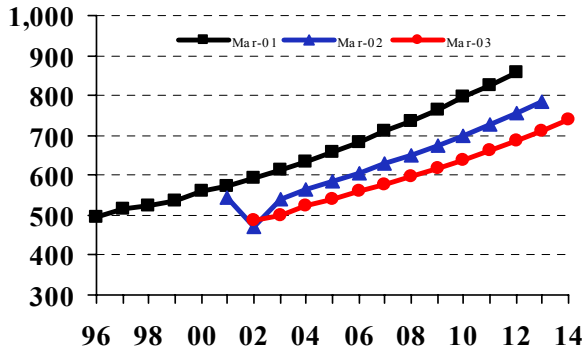




Source: Lukachko and Waitz, 2001

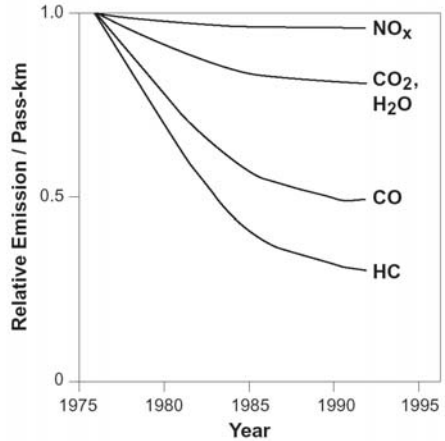
… And Key Challenges Remain

U.S. domestic passenger emplanements, millions



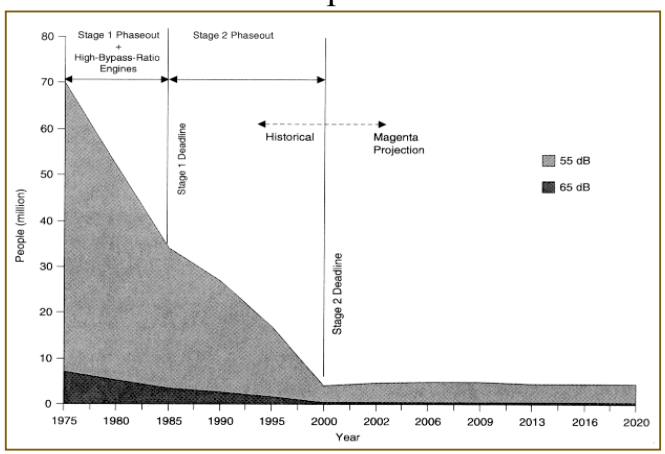
FAA Aerospace Forecasts, 2003

Trends Abating Various Aircraft Emissions



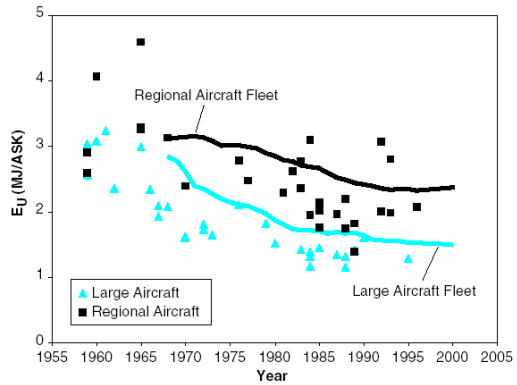
Source: Waitz, 2002, based on Boeing data

Trends in Noise Exposure to 55 DNL



Source: Lukachko and Waitz, 2001

Specific Energy Usage of Regional vs. Large Aircraft



Babikian et al., 2002

Center of Excellence Focuses the Resources of Academia, Industry and Government To Solve These Challenges

NASA-FAA Environment R&D Relationship

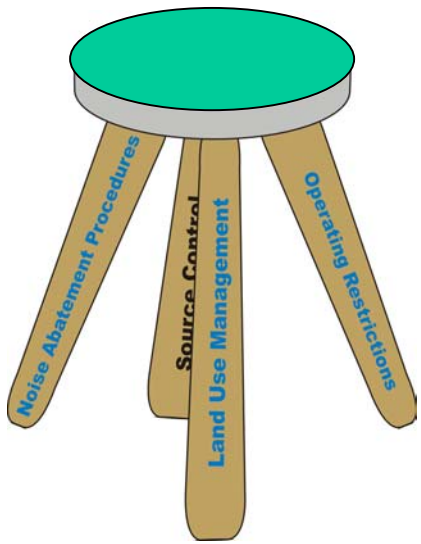
NASA – aircraft noise and emissions exploratory research, early technology development, and physics based modeling

FAA - aircraft noise and emissions modeling and assessment tools for regulatory process and aircraft certification and regulatory issues

Balanced Approach

Source Control

Abatement Procedures



Abatement Procedures

Land Use

Operating Restrictions

FAA Environment & Energy R,E&D Program

- Develop information, tools, methods, and technologies that help mitigate the adverse impacts of aircraft noise and emissions upon the environment and ease capacity concerns

Program Elements

- Noise and Emissions Analysis and Interrelationships
- Aircraft Noise
- Aviation Emissions

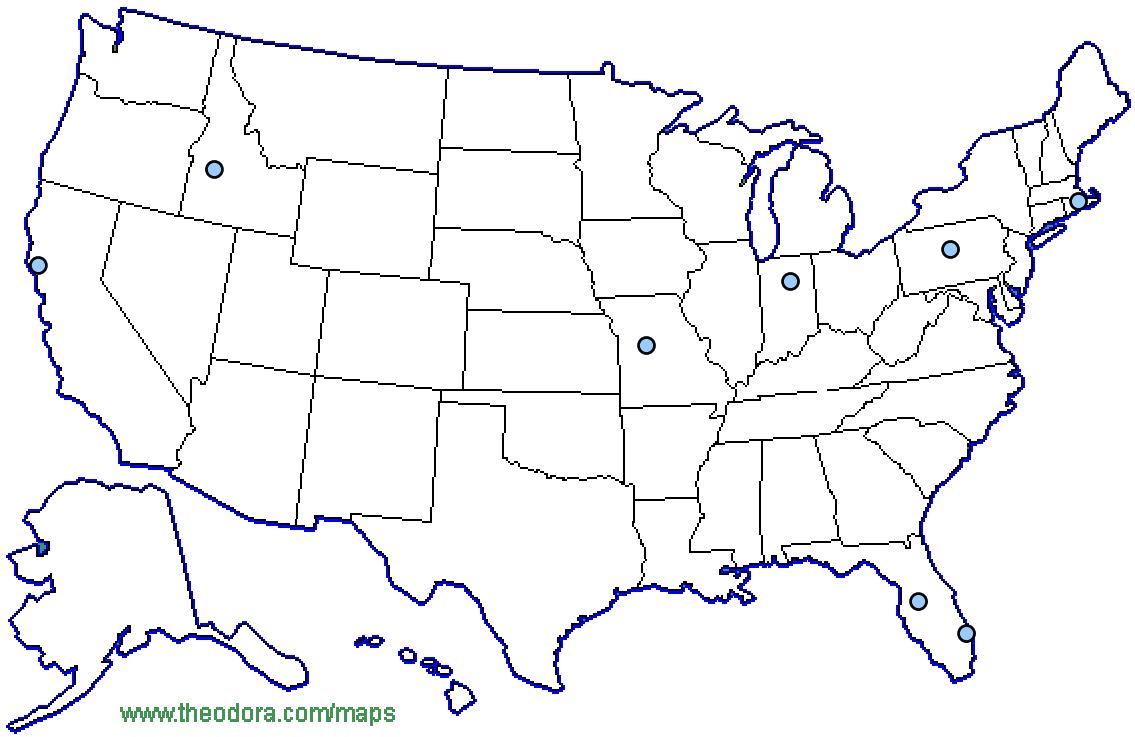
New Initiative: FAA / NASA Center of Excellence for Aircraft Noise and Aviation Emissions

- Information Meeting 6 May 2003
- Scope of Work:
  - Socio-economic Effects of Noise and Noise Mitigation
  - Noise Abatement Flight Procedures
  - Compatible Land Use Management
  - Airport Operational Controls
  - Atmospheric and Health effects of aviation emissions, including impact of hazardous air pollutants and particulate matter
- Proposals received and evaluated July 2003
- Center Established September 2003
- NASA will participate as full partner
- Exploring Partnership with Transport Canada

Noise and Emissions Center of Excellence Members

Aircraft Noise and Aviation Emissions Mitigation

Massachusetts Institute of Technology - Lead
Boise State Univ.
Florida International Univ.
Penn State Univ.
Purdue Univ.
Stanford University
Univ. of Central Florida
Univ. of Missouri-Rolla



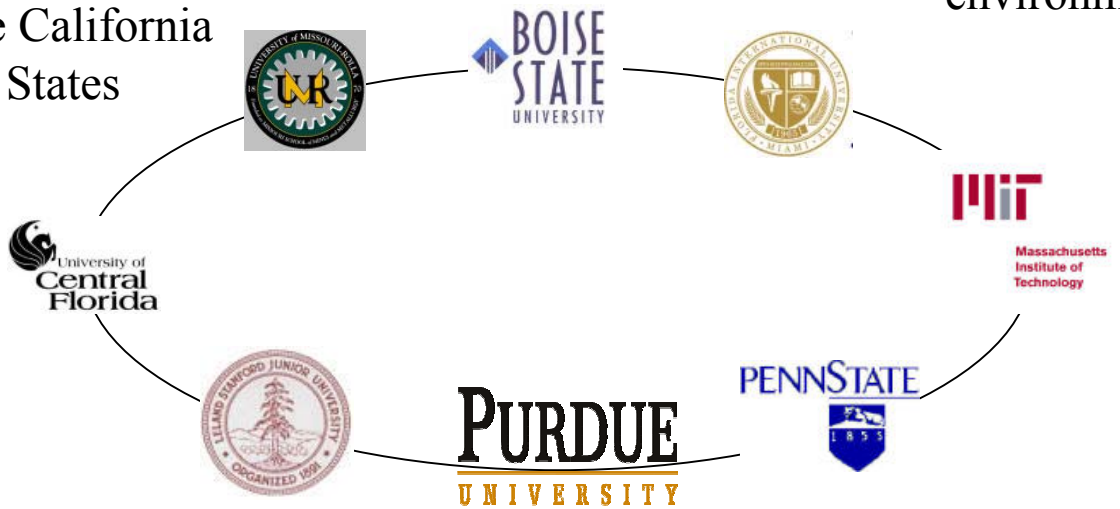
Industry Partners

American Institute of Aeronautics and Astronautics
Aerodyne Research, Inc.
Bell Helicopter Textron
Boeing
Delta Air Lines
General Electric Aircraft Engines
Gulfstream Aerospace
Logistics Management Institute
Metron Aviation
Metropolitan Washington Airports Authority
Pratt & Whitney
Raisbeck Engineering
Rannoch Corp.
Regional Airport Authority of Louisville and Jefferson County
Rolls-Royce
Sikorsky Aircraft
Wyle Laboratories
United Parcel Service

Noise and Emissions Center of Excellence
University Members Capabilities

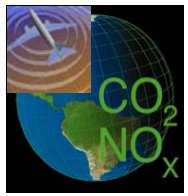
Cover the Boston, Chicago, Miami "triangle of congestion and delay" as well as sensitive California & Western States

Extensive research record addressing aviation environmental issues



Combined history of 769 years training professionals in relevant subject areas

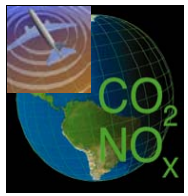
Strong, existing relationships with industry partners and Government agencies



Noise & Emissions COE First Projects

- **Low Frequency Noise Study**
  - Participants: Penn State University, Purdue, University of Central Florida, Boeing, Wyle
  - Objective: Address low frequency noise – obtain measurements and annoyance data – formulate models to facilitate developing impact metrics and mitigation techniques
- **Noise Measurements, Metrics, and Health Effects**
  - Participants: Penn State University, Purdue University, *Florida International University, University of Central Florida*, Boeing, GE, Pratt & Whitney, Rolls-Royce, Wyle
  - Objective: Correlate metrics to community response and investigate role of noise characteristics in annoyance
- **Valuation and Trade-Offs of Policy Options**
  - Participants: MIT, *Stanford*, Boeing, Delta, GE, Logistics Management Institute, Pratt & Whitney, Rannoch Corp., Rolls-Royce, Wyle
  - Objective: Valuate aviation environmental costs and assess relationship between policies and environmental impact

Universities shown in italics are not specifically funded due to budget limitations – but have capabilities to perform valuable research in subject area



Noise & Emissions COE First Projects

- **Continuous Descent Approach at Louisville International Airport**
  - Participants: MIT, Boeing, Delta, Regional Airport Authority of Louisville, UPS
  - Objective: Develop and evaluate candidate procedure and controller tools and certify low noise approach procedure for daily operations at Louisville International Airport
- **Land Use and Airport Controls**
  - Participants: Florida International University, Purdue, *MIT, University of Central Florida*, Delta, Metropolitan Washington Airports Authority, Regional Airport Authority of Louisville, Wyle
  - Objective: Evaluate effectiveness of sound insulation, assess encroachment issues, and examine land use versus airport controls to provide information to enhance land use practices around airports
- **Supersonic Transport**
  - Participants: Stanford, *Penn State*, Boeing, Gulfstream, Wyle
  - Objective: Assess applicability of existing noise metrics to sonic boom and determine annoyance of low boom waveforms to inform future decision making regarding supersonic flight over land

Universities shown in italics are not specifically funded due to budget limitations – but have capabilities to perform valuable research in subject area

Noise & Emissions COE First Projects

- **Emissions Measurements**
  - Participants: Boise State, University of Missouri-Rolla, *Florida International University, MIT, Stanford, University of Central Florida*, Aerodyne, Boeing, GE, Pratt & Whitney, Rolls Royce
  - Objective: Collect particulate matter data using Light Detection and Ranging (LIDAR) to provide data to enhance dispersion analytical models
- **Atmospheric Impact Assessment**
  - Participants: Stanford, *MIT*
  - Objective: Assess the state of knowledge on the atmospheric impact of commercial and other aircraft operating at cruise altitudes since the Intergovernmental Panel on Climate Change (IPCC) report "Aviation and the Global Atmosphere," published in 1999

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The Future?

- Environment will be a key constraint on aviation's capacity to grow
- Balanced, integrated research approach crucial to enabling solutions

PARTNER COE Attributes

- Independence
- Interagency sponsorship
- Interrelationships between noise and emissions
- International collaboration

Partnership for **A**i**R** **T**ransportation **N**oise and **E**missions **R**eduction Will Enable a Bright Future!